

Annual Report

1990-91



Centre for Resource Studies

92-00596/

**Annual Report
for the Period**

**1 May 1990 to
30 April 1991**

Centre for Resource Studies

Origins and Objectives

The Centre was established at Queen's University in 1973 to conduct research in mineral policy and mineral economics. Sponsored by the federal Department of Energy, Mines and Resources and The Mining Association of Canada, under the auspices of the University, its function is to improve understanding of the complex questions and issues underlying policies related to all mineral resources (other than oil and gas). The purposes of the Centre are accomplished through a program of research and publication, and by providing opportunities for liaison among representatives of federal and provincial governments, industry, universities, and other interested groups.

The Centre does not attempt to present the viewpoint of the mineral industry in Canada. Views expressed in all CRS publications are those of their authors, and are not necessarily shared by the Centre's sponsors. All CRS publications, with the exception of Proceedings and minor articles in *CRS Perspectives*, are subject to arm's-length review, usually by a panel of three reviewers – one academic, one industry and one government – with research and/or practical experience in a related field. The review process always leads to revisions and occasionally even to rejection of a manuscript. A listing of past reviewers of CRS manuscripts is given on pages 11 and 12.

The Centre welcomes critical comment and feedback on its research output, and hopes that its publications and other communications will provide information that is useful in the development of corporate and public policies for the mineral sector, and will stimulate further discussion and research.

Summary of Activities 1975-91

The Centre supports multidisciplinary research, with the objective of examining mineral-related economic and policy issues and their implications for the Canadian mineral industry and Canadian federal, provincial and territorial governments. The research is carried out both at the Centre and through external contracts and grants for qualified investigators, usually at Canadian universities. The Centre also accepts contract funding from other sponsors for nonproprietary research that fits within its mandate.

Research funded by or through the Centre is published, generally as monographs and working papers. As of April 1991, 25 monographs and 47 working papers have been published. In the series of technical papers introduced in 1981, 11 have been published to date. The Centre also publishes *CRS Perspectives*, an occasional newsletter commenting on issues of current interest and significance, which is distributed to a mailing list of approximately 3,500 individuals and organizations. In its first 18 years, the Centre has produced about 130 publications, with an average circulation of 500 copies, and 35 issues of *CRS Perspectives*.

Four issues of *Mineral Policy Update* (1981-84) have been published; this annual review of policy initiatives is now being revived and updated. In the Eastern Arctic Study, seven background studies and a final monograph were produced. The R&D series included 12 background studies and two final reports.

In 1977 the Centre held the first of its Policy Discussion Seminars which bring together, in a constructive working environment, invited representa-

tives with a diversity of interests to discuss a topic of current policy concern. Each seminar gives rise to a set of published proceedings which contains the text of papers presented, as well as a digest of the discussions. Twenty-one seminars have been held to date.

Through this program of research, seminars, and publication, the Centre contributes to informed discussions and a better understanding of important problems. Further details of CRS activities may be found in later sections of this report. The Executive Director and Board of Directors wish to acknowledge the contribution of CRS staff, associates, committee members, and manuscript reviewers. Without their strenuous efforts and generous donations of time, the accomplishments of the past year would not have been possible.

1990-91 Activities of the Centre

CRS research and communication activities in 1990-91 reflect some of the major concerns facing the Canadian mineral industry. The competitive position of Canadian producers continues to be the underlying concern of virtually all the research projects. Projects with a domestic focus now under investigation look at government initiatives and policies, and the impact of government policies on competitive position, R&D and productivity, corporate strategies, exploration costs, native employment, long-distance commuting, and environmental issues. An international focus can be found in current and recent research on trade agreements, studies of China as a mineral producer and market, environmental issues, and corporate strategies.

Staffing changes during the year include new responsibilities for Moira Jackson, who moved to the more flexible position of Research Associate, where she combines some administrative duties, particularly those related to publications, with research primarily on environmental issues in the mining industry. She was replaced as Assistant Director by Mary Louise McAllister, whose responsibilities include administrative support, teaching undergraduate courses, and various research interests. Mary Louise has a Ph.D. in Political Science, specializing in Canadian politics and the policy implications of communications technology. Tom Schneider has joined the CRS staff to help with the *Mineral Policy Updates* and to pursue his research interests which include Aboriginal issues.

Along with this new in-house research strength, Brian Mackenzie and Michael Doggett are continuing their mineral deposits database acquisition and application, and Margot Wojciechowski has continued her investigation of mineral-sector R&D funding.

The activities of the research members of the CRS staff go far beyond CRS publications which bear their names, although these are key measures of accomplishment. The capital of knowledge acquired by all our researchers makes them valuable sources of advice and information. A great deal of time is spent in responding to enquiries received by telephone, mail, and FAX from all parts of the world, from individuals in the mineral industry, in government, and in interest groups, as well as from academics and the media. With increasing frequency, the Centre is becoming a destination in the itineraries of visitors from abroad and from other parts of the country.

The Centre acts in many ways as a liaison among the various constituencies it was designed to serve. In addition, CRS staff contribute their time to mineral-related and academic societies and organizations, and to academic tasks such as thesis examinations and visiting lectures. Publications and presentations outside of CRS as well are listed on pages 13 to 15.



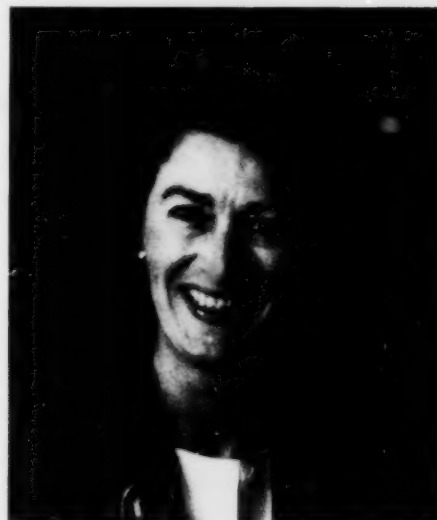
Brian Mackenzie's extracurricular activities, for example, include short courses in exploration economics as well as consulting services that take him all over the globe: in 1990/91, to Australia and Brazil. In addition, Dr. Mackenzie serves as a Corresponding Member of Council for the South African Institute of Mining and Metallurgy, as an Associate Editor for *Materials and Society*, and a member of the Advisory Board for *Nonrenewable Resources*.



Margot Wojciechowski was active in the Canadian Institute of Mining, Metallurgy and Petroleum, as Vice President of District III, and as a member of several committees of Council and of the Mineral Economics Committee. She also served as a member of two federal government advisory bodies, the Minister's National Advisory Committee on CAN-MET (MNACC) Mineral Processing Subcommittee; and the Sectoral Advisory Group on International Trade (SAGIT) Minerals and Metals Subcommittee, and as a member of the editorial board of *Resources Policy*.



Mary Louise McAllister's research activities included the task of continuing the *Mineral Policy Update* series, a massive undertaking that involves indentifying and collecting relevant material since the last volume was published for 1984. She has also been researching the policy implications of automation in the mineral industry.



A considerable amount of Moira Jackson's time during the past year was spent as a member of a Launch Committee that was an outcome of the 1990 Seminar on Human Resource Planning for the Mining Industry. This Committee's task was to facilitate a joint request by The Mining Association of Canada, the Canadian Institute of Mining, Metallurgy and Petroleum, and the United Steelworkers of America to the Minister of Employment Immigration Canada for a major study of human resource issues in the industry. The study will begin in late 1991 and will assess the factors affecting the prospects for maintaining an adequate supply of appropriately trained employees at all levels from production to senior management. She also attended a working conference at the Centre for Industrial Relations at Queen's University as a discussant on industrial relations in the mining industry.

A large number of research projects of previous years reached completion by the end of 1990/91, with 8 or 10 at or near the final stages of publication. These will be announced in *CRS Perspectives* as they are released. New projects initiated during the year include: Mineral Recycling and its Relation to Extraction; Economic Performance of Mineral Exploration in Canada; A Comparative Study of Corporate Strategy in the Australian, Canadian and Northern European Mineral Industries; and Training Aborigines for Employment in Mineral Resource Industries. A complete listing of research projects in progress and completed during 1990-91 is given on pages 6 to 11.

In November, the Centre co-sponsored, with Energy, Mines and Resources Canada, a conference on Long-Distance Commuting (LDC) in the Mining Industry. The LDC option has been identified as increasingly attractive for new mining developments in remote areas, for reasons related to cost, quality of life, and environmental impact. The conference was very well-received by the participants, and has

acted as a catalyst for further meetings and research in this subject.

CRS Perspectives has expanded in size and improved in appearance in the last year. A 3-ring binder is now available, along with complete sets of back issues, for those who wish to keep a permanent record of evolving issues in mineral economics and mineral policy as reflected in this publication since its introduction in 1978. In addition, a new policy was implemented with respect to the distribution of *Perspectives*. While CRS would prefer to continue sending it free of charge to everyone who might have an interest in its contents, it is necessary to find a way to offset, at least partially, the increased costs of the new format, as well as rising costs of production and mailing. Initially, all readers have been invited to make an annual donation of \$10. The response has been quite satisfying. In 1992, a subscription price will be introduced.

The work of the Centre for Resource Studies is of value to its sponsors and its audience only if it reaches those who can use it, in a clear and readable form. With this in mind, we encourage all our readers to let us know their views on CRS publications, their quality, their readability, and their relevance. We also appreciate suggestions on economic and policy issues in need of research, and on the names of individuals or organizations who should be on our mailing list, either as information sources or as additions to our audience.

Research Completed in 1990/91

Research Funded by CRS

Economic Analysis of Western Canadian Export Coal Supply

David L. Anderson, School of Business, Queen's University

This study examined the economic structure of the western Canadian export coal industry. It addressed the industry's rapid development since 1960, especially in the post-1980 period. Particular attention was placed on the debate surrounding the northeast British Columbia coal project. The study also described and assessed the problems currently facing export coal producers and outlined the industry's future prospects. A number of papers based on the research have been published in various journals and an edited collection will be published by CRS.

Australian and Canadian Export Coal: A Policy Analysis of Relative Competitiveness

David Anderson, School of Business, Queen's University; and Donald W. Barnett, Macquarie University, Australia

The relative competitiveness of Australian and Canadian export coals in the Pacific Rim market is examined in this study. The analysis focuses on the domestic cost structure of each industry with special attention given to operating costs, non-profit and profit-based taxes, domestic transportation levies, and infrastructure financing arrangements. Nine papers based on this project and the one described above have been published in various journals, and an edited collection will be published by CRS.

Mineral Recycling and its Relation to Extraction

Anya Hageman, Department of Economics, Queen's University

The relationship between recycling and extraction in relation to Hotelling's theory of resource exhaustion is the focus of this research, which tests the validity of the theoretical findings with Canadian mining data. A manuscript has been received and is in the review process.

Sulphur Mining in Poland

Leszek Preisner, Institute of Economics, University of Mining and Metallurgy, Poland

Canada and Poland rank third and fourth respectively in world exports of sulphur. This study presents a history and present evaluation of Poland's sulphur mine production and exports and speculates on the future. The study has been published as a CRS working paper.

Development and Restructuring of China's Metal Mining Industry

Xu Tao, Centre for Resource Studies

China's potential for supply and demand for mineral products has been a subject of much speculation. This project considers possible directions for and the potential for success of the a restructuring of China's metal mining industry. The investigation compares and analyzes information from different sources, including recent Chinese official statistical data. The interests of China and its trading partners are considered, as well as those of Canadian mineral producers. The study will be published as a CRS working paper.

Externally Funded Research

Firm Level Productivity Measurement for the Ontario Metal Mining Industry

Alan Green and Ann Green, Department of Economics, Queen's University

This study builds on previous work by the researchers in this area. Using more-detailed firm-level observations on inputs and outputs, it was possible to assess the impact of such factors as industry rationalization and changes in product mix on the industry's performance. In addition, analyses were made to differentiate the effects on profits due to price changes and due to productivity improvement. A manuscript has been received and reviewed.

Uranium Mining in Canada and Australia: The Impact of Taxation

Brian W. Mackenzie and Michael Doggett, Centre for Resource Studies, and Richard M. Williams and Robert T. Whillans, Energy, Mines and Resources Canada

Representative uranium-mining project profiles are developed for four types of deposit: high-grade unconformity type, quartz pebble conglomerate type, conventional-grade unconformity type, and uranium-base metal type. Each of the four projects is first evaluated on a potential, before-tax basis. Then the impact of taxation on each project is examined for three locations: Saskatchewan, one other Canadian province or territory, and one Australian state or territory. Results are presented, compared, and analyzed using economic measures of project viability, investment incentive, tax burden, and competitive position. This project was funded by the Uranium and Nuclear Energy Branch of Energy, Mines and Resources Canada and will be published as a CRS monograph.

Mineral Exploration and Development Potential in Manitoba: Guidelines for Policy Formulation

Brian W. Mackenzie and Michael Doggett, Centre for Resource Studies, Michel Bilodeau, Department of Mining and Metallurgical Engineering, McGill University

The study had three objectives:

- assessment of the economic potential of mineral exploration and mine development in Manitoba;
- examination of Manitoba's competitive standing in the shield region and in Canada;
- analysis of the effects of Manitoba's mining taxation policy on economic potential and competitive standing.

The first phase of the study focused on Manitoba-specific assessments using the existing CRS database for base metal and gold mining. In the second study phase, Manitoba exploration expenditure and mineral deposit data were revised, updated, and expanded to include nickel. The time series was extended to include 1986-88, and the effects of an appropriate range of Manitoba mining taxation policy options were examined. A second contract was awarded to conduct further evaluation and analysis of Manitoba's mining taxation options based on the previous study's findings. A CRS publication will follow.

Update of Sourcebook on Native Participation in the Mineral Industry

Mary Louise McAllister and Tom F. Schneider, Centre for Resource Studies

The objective of this project was to list and describe the federal government programs which could be used by Native individuals, organizations, companies, or communities to participate in employ-

ment, entrepreneurial, investment, equity or other activity participation, and regulatory requirements related to the mineral industry (excluding oil and gas). A final report has been submitted and released as part of a DIAND publication.

*Canadian University Research and Teaching
Resources in Advanced Industrial Materials*

John McIntosh, Department of Chemistry, University of Windsor, and Margot J. Wojciechowski, Centre for Resource Studies

As well as evaluating the accuracy and usefulness of two previous studies in this field, this project also looked at existing strengths and weaknesses, and suggested a framework for monitoring future trends in AIM resources in Canadian universities. A final report has been submitted to the sponsor, Industry Science and Technology Canada, and a CRS technical paper has been published.

Research in Progress

Research Funded by CRS

Incentives, Risk and Optimal Extraction in the Mining Firm

Christopher Ferrall and Bruce Shearer, Department of Economics, Queen's University

The objective of this project is to collect data from the historical records of the Britannia Mining Company, British Columbia. The data contains information on wages, bonus payments and hours of work for individuals who worked in this copper mine from the late 1920s until the 1970s. These data will be matched with data that have already been collected on worker characteristics, employment histories, and accident rates in the mine.

Pricing and Trade Policy in the Canadian Resource Sector

Tim Hazledine, Department of Agricultural Economics, University of British Columbia

This study will analyze the impact on the resource sector of future cuts in Canadian and foreign tariffs on tradable goods. The study will examine both the direct (partial equilibrium) impact that elimination or reduction of a tariff on a resource commodity has on the price paid in Canada for that commodity, and the indirect (general equilibrium) impact through changes in input prices and the exchange rate of across-the-board tariff changes on all traded goods. As well, the implications for the sector of flattening of "effective protection" (higher tariffs on more highly processed products) will be analyzed.

Economic Analysis of Canadian Gold Supply

Brian Mackenzie and Michael Doggett, Centre for Resource Studies

A comprehensive mineral deposit data base is being assembled to document short-, medium-, and long-term aspects of Canadian gold supply, concentrating on trends during the period 1946-85. This information has been organized on micro-computer spreadsheets for evaluation and analysis, and integrated with the economic evaluation procedures and base metal database which has been developed at CRS since 1975.

Nine papers have resulted from this ongoing project to date, including three CRS publications.

The database has recently been extended to include 1986-88, and was most recently applied in two externally funded contracts for the Manitoba Department of Energy and Mines, completed in November 1990 and March 1991. A keynote paper on "Worldwide Trends in Gold Exploration" has been prepared for presentation at the Brazil Gold '91 Symposium in Belo Horizonte during May 1991.

Economic Performance of Mineral Exploration in Canada

Brian W. Mackenzie and Michael Doggett, Centre for Resource Studies

Prompted by long-standing interest and research in exploration decision-making and efficiency, and current industry and government concerns about the state of mineral exploration in Canada, this study will apply the knowledge and experience gained in earlier work on mineral exploration economics, utilizing the extensive CRS deposit-specific database and associated evaluation procedures. The focus will be on those aspects of the subject which are compatible with the CRS mandate and which can be handled readily and efficiently in-house.

One primary question is being addressed: Is Canadian mineral exploration an economic investment and, more intrinsically, a wealth-creating activity? To answer this query, the project will examine the economic performance of base metal, gold and nickel exploration in Canada since the second world war. The assessments are to be made in a way that is relevant for present-day policy and planning purposes. Suggestions will be made as to how the study results can be used to support the analysis of government mineral policy issues.

Exploration Expenditure and Mineral Deposit Database

Brian Mackenzie and Michael Doggett, Centre for Resource Studies

An extensive deposit-specific base metal database has been developed at the Centre for Resource Studies and continually updated since 1975 to assess the potential value of mining in Canada, and to measure the direct effects of government mineral policies on producers of base metals, gold, nickel and uranium in Canada. This work continued in 1989-91 in conjunction with two CRS contracts funded by the Manitoba government. The database is being used in the current CRS study of the

economic performance of mineral exploration in Canada.

Mining Project Evaluation Software Package

Brian Mackenzie and Michael Doggett, Centre for Resource Studies, and Michel Bilodeau, Department of Mining and Metallurgical Engineering, McGill University

This project involves the development of a user-friendly software package and the preparation of a manual to make the software accessible to the user. The software is designed for use in government and industry by geologists, economists and engineers responsible for the economic evaluation of mineral deposits. Government policy applications include the analysis of mining taxation options, mineral exploration assistance programs, environmental control costs, infrastructure support for new mine development, and regional development incentives. In mining companies, the software can be applied to the evaluation of mineral exploration and development opportunities, minimum acceptable exploration target conditions, alternatives for structuring agreements, optimum mine development decision variables, and expansion of mining or mineral processing capacity. The software includes sensitivity analysis and probabilistic risk analysis options. Particular attention is given to the modelling of mining taxation systems and the examination of taxation and royalty effects.

Feedback from demonstrating and using prototype software at professional development seminars in mineral economics has assisted the work. The manual, to be prepared during the summer of 1991, will describe the economic evaluation techniques used, outline the information requirements, discuss the taxation components, and provide detailed instruction on software use, including case study examples to illustrate the range of intended policy and planning applications. The package is to be produced and marketed by CRS.

Mineral Policy Update

Mary Louise McAllister, Centre for Resource Studies

Last published in 1984, this series monitors policy and program changes and initiatives introduced by the federal government and the governments of all the territories and provinces. A volume covering 1985-89 and a retrospective 1990 volume are in preparation. Some sections are presently in the review process.

China and the World Mineral Markets: Threats and/or Opportunities

Carmine Nappi, École des Hautes Études Commerciales

Essentially an economic and statistical analysis of China's mineral industry, the study will present the main characteristics of this industry, identify (and explain) the minerals for which China has a clear comparative advantage or disadvantage on the international market, analyze the effects of China's mineral exports and imports on western markets and evaluate the policy implications for the Canadian government and producers. The analysis will cover the 1970-1988 period, with some speculations for the period 1990-2005. A special emphasis will be placed on minerals and metals which are particularly important for Canadian producers: aluminum, asbestos, copper, iron ore and steel products, lead, nickel, and zinc.

Environmental Impact of Mining in Canada

E.A. Ripley and R.E. Redmann, Department of Crop Science and Plant Ecology, University of Saskatchewan, Adèle Crowder, Department of Biology, Queen's University, and Thomas Hynes, Inco Limited

A 1978 CRS monograph by Ripley and Redmann will be expanded and updated with respect to changes in the mining industry and changes in

pollution control. One area of weakness in the original monograph, aquatic ecology, will be strengthened.

A Comparative Study of Corporate Strategy in the Australian, Canadian, and Northern European Mineral Industries

Peter R. Richardson, School of Business, Queen's University

The research will document and analyze approaches to strategy formulation and implementation in six major integrated mineral corporations. Comparisons will be drawn between the approaches used in each corporation, and implications for future growth, performance and strategy will be discussed.

Training Aboriginals for Employment in Mineral Resource Industries: An Assessment

Tom Schneider, Centre for Resource Studies and Dan Johnson, Department of Political Studies, Queen's University

This research will investigate the current state and the relevance of training policy and programs for aboriginal people in Canada's northern mineral resource industry. The proposal stems from a belief that there are valid and pressing reasons, both political and economic, for improving the current level of Native employment in the northern mining industry.

R&D Funding in the Mineral Sector

Margot Wojciechowski, Centre for Resource Studies

The project draws on the information gathered in the course of two comparative studies of mineral-related R&D funding conducted by CRS, one in Earth Sciences which was commissioned by the Canadian Geoscience Council, and one in mining and metallurgy which was commissioned by CAN-MET. This second phase of the study will extend the time trends for the eight OECD countries included in the original study.

Externally Funded Research

Towards More Efficient R&D in the Ontario Mineral Sector

Alan Green and Ann Green, Department of Economics, Queen's University

The study proposed here will analyze the process by which R&D affects the Ontario mining industry. Successful adoption of best-practice technology while husbanding corporate and government resources is a key factor in ensuring that this industry remains a strong competitor in the world market for minerals.

Reviewers for CRS Publications in the Past Five Years

All CRS research papers are subjected to an arm's-length review process prior to publication. Each year, individuals contribute greatly by reviewing CRS manuscripts, and examining their relevance, usefulness, and suitability for publication. In many cases, these reviewers devote a great deal of time preparing constructive comments that are extremely useful to the authors and editors. In the past, largely in the interests of protecting the traditional anonymity of reviewers, no public acknowledgement has been made of their contribution to the quality of CRS publications. We have decided to modify this policy; this year's Annual Report therefore includes the following list of those who have reviewed CRS manuscripts in the last five years, as a small expression of our appreciation for their efforts on our behalf. Their affiliations are, of course, shown as they were at the time the review was performed. To any who may have been inadvertently omitted, our apologies as well as our thanks.

D.L. Anderson, Queen's University
E. Arundell, Abitibi-Price
J.A.E. Bell, Inco Limited
J. Berlinsky, McMaster University
A. Bourassa, Energy, Mines and Resources Canada
K. Brewer, Energy, Mines and Resources Canada
K. Buck, Consultant
D. Burnstead, Noranda Minerals Inc.
B. Campbell, Ontario Mining Association
P. Caragata, Toronto-Dominion Bank
C. Carson, Falconbridge Europe
M. Chandler, University of Toronto
D. Cranstone, Energy, Mines and Resources Canada
H. Cummer, Canpotex Limited
W. Curlook, Inco Limited
W.G. Deeks, Noranda Minerals Inc.
Y. Dionne, Ministère de l'Énergie et des Ressources du Québec
R.C. Drury, Colorado School of Mines

- A.W. Easton*, Cominco Limited
- J. Finlayson*, Business Council on National Issues
- A.J. Freyman*, Ministry of Northern Development and Mines
- D.B. Gladwin*, Energy, Mines and Resources Canada
- M.K. Hawes*, Queen's University
- D. Hull*, Energy, Mines and Resources Canada
- W. Isotalo*, Department of Finance
- W.G. Jeffrey*, CANMET
- D. Jillings*, Saskatchewan Energy and Mines
- G. Jones*, Noranda Sales Corporation
- M. Kamal*, McGill University
- L. Kilburn*, Prospectors and Developers Association
- W. Labys*, West Virginia University
- D.J. Lecraw*, University of Western Ontario
- I. Levy*, Pancontinental Mining Limited
- R. Lote*, Noranda Minerals Inc.
- P. MacCulloch*, BP Selco Limited
- H. Maciej*, Canadian Petroleum Association
- K. Mackenzie*, University of Toronto
- P. McGeer*, Queen's University
- B. McCrear*, B.C. Energy, Mines and Petroleum Resources
- B.A. McKean*, Energy, Mines and Resources Canada
- P. Mieszkowski*, Consultant
- C.G. Miller*, The Mining Association of Canada
- J. Mintz*, University of Toronto
- D.L. Morgan*, Placer Dome Inc.
- C. Nappi*, École des Hautes Études Commerciales
- E.K. O'Brien*, Inco Limited
- N. Olewiler*, Queen's University
- K.S. Palda*, Queen's University
- R.B. Parsons*, Price Waterhouse
- G. Peeling*, Energy, Mines and Resources Canada
- G.M. Penna*, Noranda Minerals Inc.
- F.G.T. Pickard*, Falconbridge Limited
- M. Prud'homme*, Energy, Mines and Resources Canada
- R. Reid*, Saskatchewan Energy and Mines
- M. Robinson*, Inco Gold
- D. Sawicki*, Resources for the Future
- M.J. Scoble*, McGill University
- V.H. Smith*, Queen's University
- K. Spurr*, Consultant
- J. Tilton*, Colorado School of Mines
- W. Toms*, Finance Canada
- W.J.M. Wenzel*, Intcan Sulphur Technologies
- B.W. Wilkinson*, University of Alberta
- G. Wittur*, Energy, Mines and Resources Canada

New Publications

The following new publications arising from the CRS research and seminar programs were released during 1990-91.

Response to Crisis: The Ontario Metal Mining Industry, 1975-1985, by A.G. Green and M.A. Green; 35 pp, 1991 (Working Paper no. 45)

The Evolution of the Manufacturing Component in the Ontario Metal Mining Industry, by A.G. Green and M.A. Green; 60 pp, 1991 (Working Paper no. 46)

Canadian University Research and Teaching Resources in Advanced Industrial Materials, by J.M. McIntosh; 71 pp, 1991 (Technical Paper no. 11)

Sulphur Mining in Poland, by L. Preisner; 26 pp, 1991 (Working Paper no. 47)

Publications outside CRS by CRS Researchers

Moirra Jackson

"Don't Just Stand There", *Northern Miner Magazine*, June 1990.

Brian Mackenzie

"Economia de la Exploracion Minera: Enfoque Orientado a Promover su Exito", *Minerales*, Quarterly Review, Chilean Institute of Mining Engineers, Santiago, October-December 1989, pp. 21-37.

"Economics of Gold Deposits", pp. 399-426 in *Gold Metallogeny and Exploration*, R.P. Foster ed., Blackie, Glasgow, 1991, 456 pp.

Economic Potential of Gold Exploration and Development in Brazil: Progress Report II, prepared for Departamento Nacional da Producao Mineral (DNPM), Brasilia, May 1990, 39 pp.

Economics of Petroleum Exploration in Australia, with Zhi Cai, Draft final report and statistical appendix, prepared for Western Mining Corporation, Adelaide, May 1990, 128 pp. and 282 pp.

Mineral Exploration and Development Potential in Australia, with M. Doggett, draft final report, prepared for Western Mining Corporation, Adelaide, May 1990, 135 pp.

Presentations by CRS Researchers

(Based on CRS-related work)

Molra Jackson

"The Status Quo Is Not Enough", presentation at CIM Annual General Meeting, Ottawa, 8 May 1990.

"Economic Aspects of Mining and the Environment", Saskfuture Conference on Economy and the Environment, Regina, 28 September 1990.

"Sustainable Development: Defining the Terms", Department of Political Studies, Queen's University, 25 March 1991.

"Environmental Behaviour of International Mining Enterprises: A Canadian Case Study", Mining and Environment Workshop, Science Policy Research Unit, University of Sussex, Sussex, England, 11 April 1991.

Brian Mackenzie

"Economic Guidelines for Mineral Exploration and Mining Project Development", seven-day seminar, Australian Mineral Foundation, Adelaide, June 1990.

"Economic Guidelines for Mineral Exploration", six-day seminar, WMC Mineracao, Gioania, Brazil, August 1990.

"Economic Guidelines for Mineral Exploration and Mining Project Development", six-day seminar, ABRAMO-Associacao Brasileira dos Mineradores de Ouro, Itaipava, Brazil, October 1990.

"Economic Guidelines for Mineral Exploration", six-day seminar, Department of Geological Sciences, Queen's University, December 1990.

"Impact of Taxation on Uranium Mining in Canada and Australia", Energy, Mines and Resources Canada, Ottawa, 18 October 1990.

"Economic Potential of Mining in Manitoba", Mining Association of Manitoba, Winnipeg, 17 January 1991.

"Direct Effects of Mining Taxation in Manitoba", Tax Committee on the Minister's Task Force on Mining in Manitoba, Winnipeg, 18 January 1991.

"Economic Potential of Mineral and Petroleum Resources to Society", lecture in MINE 101, engineering linkage course on the Canadian Primary Industry in a Global Economy, 19 March 1991.

"Examination of Manitoba Mining Taxation Options", presentation to Ministers of Finance and Mines, Government of Manitoba, Winnipeg, 22 March 1991.

Mary Louise McAllister

"Canadian Policy Making in an International Context: the Value of Spectrum Resources", Inservice Master's Program, School of Public Administration, Queen's University, September 1990.

"Access to Government Information", Graduate Studies Program, School of Public Administration, Queen's University, November 1990.

Public Administration, full-year seminar course, Department of Political Studies, Queen's University

Margot Wojciechowski

"Impact of Public Policy - Nickel", presentation to Nonferrous Metals Expert Group, UNIDO, Vienna, June 28, 1990.

"The Natural Resource Industries in Canada: Economic Impacts", lecture in Queen's Faculty of Applied Science, January 29, 1991

"The Mining and Metals Industry in Canada: Social and Political Impacts", lecture in Queen's Faculty of Applied Science, February 28, 1991

CRS Policy Discussion Seminars

The CRS Policy Discussion Seminars are designed to bring together senior individuals from federal and provincial governments, corporations, universities, trade unions, and other interested groups to discuss current mineral policy issues. The informal atmosphere is conducive to the free and constructive exchange of views. In a typical two-day session, six or eight speakers present background information and views on the issue. Subsequent discussion in small groups and open sessions allow the participants to develop a mutual understanding of the problem and of other viewpoints, and to discuss potential solutions. The proceedings are published, including the papers and some analysis and conclusions.

Long-Distance Commuting Conference

In November 1990, a seminar on Long-Distance Commuting (LDC) was held in Saskatoon, jointly sponsored by EMR and CRS. The seminar brought together an interdisciplinary group representing senior levels in the mining industry, government and

university. Its purpose was to explore the implications of the trend toward the selection of the LDC option for new mining developments, and to encourage the sharing of different experiences, perspectives and suggestions. The consensus among participants was that the seminar was useful and constructive, and delegates from Australia decided to plan a similar conference. CRS will publish an edited volume of selected papers from both the Canadian and Australian conferences.

Following presentations by M. Shrimpton and K. Storey and N. Lightfoot to set the foundation for discussion, five panels considered specific aspects of LDC.

Logistics Issues (Chair, D. Somers)

Panelists: L. Gould, J. Hopkinson, C. Loberg

Workforce Issues (Chair, G. Kendall)

Panelists: M. Shrimpton, K. Storey, D. Coates, B. Welke, B. Hanson, C. Gitzel

Community Issues (Chair, M. Shrimpton)

Panelists: K. Donnelly, P. Bray, A. Allard, and R. Robson

International Perspectives (Chair, R. Sully)

Panelists: R.A. Whiffen, and C. Hinde

Canadian Case Studies (Chair, K. Storey)

Panelists: N. Ringstead, W. Fotheringham, M. Babcock, and R. Armstrong

CRS Perspectives

Three issues of *CRS Perspectives* were published during the current year. *Perspectives* is an occasional newsletter that contains comment about the Canadian mineral industry, reviews, and news of CRS activities and publications. It includes both opinion pieces and articles which have undergone the scholarly review process. *Perspectives* is sent within Canada and abroad to the entire CRS mailing list of about 3,500 individuals and institutions with interests in mineral policy issues.

The July 1990 issue of *Perspectives* included articles by Tom Schneider, "Beyond Land Claims: The Future of Northern Development"; Zhang Lei and Daniel Todd, "The Development of China's Mining Industry and its Relevance"; and Moira Jackson, "Human Resource Planning for the Mining Industry".

Feature articles in the October 1990 issue were by Margot Wojciechowski, "R&D Expenditures by the Canadian Mineral Industry"; Patrick MacCulloch, "Recruitment and Training for the Mining Industry"; F. Clyde Lendrum, "Development of Uranium Mining Effluent Regulations in Canada"; and Lyle V.A. Sendlein, "Where Does Research Fit Into a National Energy Strategy?".

The February 1991 issue featured articles by Moira Jackson, "W(h)ither Investment?"; Mary Louise McAllister, "Mineral Policy Annuals: Reviewing the '80s, Contemplating the '90s"; and M.M. McDonald and J.B. Railton, "The Coal Association of Canada's IGCC Project".

Back issues of *CRS Perspectives* provide an interesting overview of evolving issues related to mineral policy and economics. CRS now offers complete sets of *Perspectives* from its introduction in 1978, plus a subject and author index, in a 3-ring binder.

Financial Arrangements

The Centre disbursed \$332,464 on administrative and \$278,279 on research activities during the year.

Continuing financial support is received from The Mining Association of Canada and Energy, Mines and Resources Canada. Funding from The Mining Association of Canada for 1990-91 was \$248,915 (\$97,396 for administration and \$151,519 for research). Funding from Energy, Mines and Resources Canada for 1990-91 was \$196,000 (\$78,400 for administration and \$117,600 for research). A total of \$36,111 was recovered from the sale of publications and seminar registration fees.

The Centre also seeks to serve the research needs of other agencies. In the current year, research support was received in the amount of \$230,994 from agencies other than the Centre's permanent sponsors, for projects within the Centre's mandate and of a non-confidential nature.

The Board of Directors

The Board consists of sixteen members. Four are appointed by The Mining Association of Canada, three by Energy, Mines and Resources Canada, seven by the Principal of Queen's University, and two (the Executive Director of CRS and the Chairman of the Advisory Council) are ex-officio. In addition, the chairman of the Research Advisory Committee has observer status at Board meetings. The chairman of the Board of Directors in 1990/91 was C. George Miller, President of The Mining Association of Canada.

The Board met twice during the year; the fall meeting took place October 22, 1989, in Kingston (pictured below) and the spring meeting was held April 24, 1990, in Toronto. On these occasions, the Board discussed a number of ongoing and potential research themes, the recommendations of the Advisory Council, and various administrative and policy matters.

During 1990-91, Richard Simeon retired from the Board, Robin Boadway was reappointed and John Holmes was appointed by the Principal.

Members of the 1990-91 Board of Directors were as follows:

J. Auston, BP Selco Limited
I.D. Bayer, Hemlo Gold Mines Inc.
J. Beausoleil, Department of Finance
R.W. Boadway, Queen's University
T.J. Courchene, Queen's University
J.M. Dixon, Queen's University
A.R. Eastham, Queen's University
J.T. Jubb, CANMET
N. Lyon, Queen's University
C.G. Miller (Chairman), The Mining Association of Canada
D.L. Morgan (Chairman, AC), Placer Dome Inc.
E.K. O'Brien (Chairman, RAC), Inco Limited
R.E. Simeon, Queen's University
R.M. Smith, American Barrick Resources Corp.
R.W. Smith, Queen's University
R. Sully, Energy, Mines and Resources Canada
M.J. Wojciechowski, Centre for Resource Studies



Advisory Groups

Advisory Council

The Advisory Council currently has a membership of 46 appointed members. These members, from government, industry, labour, the professions, and other interested organizations and groups, are appointed for a three-year term. In addition, all researchers associated with the work of the Centre are appointed to membership for the duration of the research or a minimum of one year. The functions of the Council are to advise the Board of Directors, primarily on the research program, and to act as advisors to the Centre's researchers.

The Council's 1990 annual meeting was held on October 23, under the chairmanship of Donn Morgan. Reports on the Centre's ongoing activities were received and discussed, along with presentations by a number of CRS and external researchers.

Advisory Council members for 1990-91 were as follows:

Appointed Members

- D.L. Anderson*, Queen's University
B.J. Barton, Canadian Institute of Resources Law
M. Bilodeau, McGill University
K. Brewer, Energy, Mines and Resources Canada
W.K. Buck, Consultant
S. Campbell, Mining Association of B.C.
D. Davis, The SNC Group
M.J. Day, Alberta Department of Energy
M. Doggett, Centre for Resource Studies
A. Dorr, Industrie du Commerce et Tourisme, Québec
D. Eldon, The Mining Association of Canada
J.M. Fleming, Newfoundland Department of Environment and Lands
J. Gana, CESCO, Chile
J. Garnett, Consultant
J. Gillies, Falconbridge Limited
R.G. Ginn, Prospectors and Developers Association
A.G. Green, Queen's University
D.G. Haglund, Queen's University
I. Haugh, Manitoba Department of Energy and Mines
B. Haystead, Canadian Imperial Bank of Commerce
D. Hull, Energy, Mines and Resources Canada
L.M. Jackson, Centre for Resource Studies
W.G. Jeffery, The Mining Association of Canada
R.J. Keyes, Energy, Mines and Resources Canada
J. Laurie-Lean, Industry, Science and Technology Canada
J. Lazarovich, Indian and Northern Affairs Canada
M.J. Lebuis, Ministère de l'Énergie et des Ressources du Québec
G.B. MacEwen, New Brunswick Department of Natural Resources and Energy
B.W. Mackenzie, Centre for Resource Studies
G. Mahoney, Ministère de l'Énergie et des Ressources du Québec
R. Mason, Queen's University
M.L. McAllister, Centre for Resource Studies
G.B. McRae, British Columbia Department of Energy, Mines and Petroleum Resources
D.L. Morgan (Chairman), Placer Dome Inc.
J.H. Nantel, Centre de Recherche Noranda
C. Nappi, École des Hautes Études Commerciales
D.E. Nutter, N.W.T. Chamber of Mines
E.K. O'Brien, Inco Limited
N.D. Olewiler, Queen's University
G. Peeling, Energy, Mines and Resources Canada
R. Potter, Nova Scotia Department of Mines and Energy

P. Reid, Ontario Mining Association
P.R. Richardson, Queen's University
T. Schneider, Centre for Resource Studies
J.E. Tilton, Colorado School of Mines
M.J. Wojciechowski, Centre for Resource Studies
P.S. Youzwa, Saskatchewan Energy and Mines

Research Members

D.W. Barnett, Macquarie University
C. Ferrall, Queen's University
M.A. Green, Queen's University
A. Hageman, Queen's University
J. Hartwick, Queen's University
T. Hazledine, University of British Columbia
D. Johnson, Queen's University
P.C. MacCulloch, Consultant
J.M. McIntosh, University of Windsor
C. O'Faircheallaigh, Griffiths University
R.E. Redmann, University of Saskatchewan
E.A. Ripley, University of Saskatchewan
K. Rutherford, Queen's University
S. Salaff, Consultant
B. Shearer, Queen's University
Xu Tao, Centre for Resource Studies



The CRS Annual Dinner provides an opportunity for contact between industry, academic and government. Pictured above are Mary Louise McAllister (CRS), Carmin Nappi (École des Hautes Études Commerciales) and Gilles Mahoney (Ministère de l'Énergie et des Ressources du Québec). Below, David Haglund of Centre for International Relations, Queen's University talks with keynote speaker Klaus Zeidler, President and Chief Executive Officer of Metall Mining Corporation.



The Research Advisory Committee

The Research Advisory Committee was formed in 1976 to advise the Board of Directors and executive director of CRS on research goals and priorities, and on the selection of external research projects. The Committee consists of individuals knowledgeable about the mineral industry and about research methods, who are selected from industry, government, private consulting, and universities. The Committee decides on the allocation of grants-in-aid of research and advises on the awarding of research contracts. The Committee members are all members of the Advisory Council of CRS as well.

Research Advisory Committee members for 1990-91 were as follows:

D.L. Anderson, Queen's University
B.J. Barton, Canadian Institute of Resources Law
W.K. Buck, Consultant
D. Eldon, The Mining Association of Canada
B. Haystead, Canadian Imperial Bank of Commerce
D. Hull, Energy, Mines and Resources Canada
R.J. Keyes, Energy, Mines and Resources Canada
G.B. McRae, British Columbia Department of
Energy, Mines and Petroleum Resources
D.L. Morgan, Placer Dome Inc.
J.H. Nantel, Centre de Recherche Noranda
C. Nappi, École des Hautes Études Commerciales
E.K. O'Brien (Chairman), Inco Limited
G. Peeling, Energy, Mines and Resources Canada
M.J. Wojciechowski, Centre for Resource Studies



At the 1989 Annual Dinner, left to right John Auston, Moira Jackson, David Haglund and John Dixon

Personnel

Members of the Centre staff coordinate the program of external research, carry out studies in-house, edit and produce the Centre's publications, organize seminars and meetings, and provide staff services to the Board and Advisory Council. Other related professional activities include participation in conferences and seminars, speaking engagements and teaching, publication of professional writings, and consultation with other researchers.

During 1990-91, the staff and associates of the Centre were as follows:

Core Staff

Michael Doggett, Research Associate
Moirra Jackson, Research Associate
Brian W. Mackenzie, Senior Research Associate;
and Professor, Department of Geological Sciences
Mary Louise McAllister, Assistant Director; and
Adjunct Assistant Professor, Department of
Political Studies
Tom Schneider, Research Associate
Dorothy Smith, Administrative Secretary
Donna Stover, Senior Administrative Assistant
Margot Wojciechowski, Executive Director

Visitors

Pat MacCulloch, Distinguished Visitor
Xu Tao, Visiting Researcher

Faculty Associates

Michel Bilodeau, Department of Mining and Metallurgical Engineering, McGill University
Alan Green, Economics, Queen's University
David Haglund, Political Studies, Queen's University
Peter Richardson, School of Business, Queen's University

Occasional Staff

In addition, many others have assisted in the work of the Centre at various times. The contributions of Bruce Anderson, Lisa Beaubien, Tim Berrett, Jeffrey Minnema, Linda Noble, Bill Orme, Sukhwinder Singh, Jennifer Smith and Jeremy Smith are gratefully acknowledged.

Complete Listing of CRS Publications

CRS publications still in print can be ordered from:

Centre for Resource Studies, Queen's University, Kingston, Ontario, Canada K7L 3N6 (613-545-2553)

Out-of-print publications (*) can be ordered from:

Micromedia Limited, 20 Victoria Street, Toronto, Ontario, Canada M5C 2N8

Monographs

- | | |
|---|---|
| <p>M 26 Uranium Mining in Canada and Australia: The Impact of Taxation, by B.W. Mackenzie, R.T. Whilns, R.M. Williams, and M.D. Doggett; 199 pp, 1991 (\$30.00)</p> <p>M 25 U.S. Trade Barriers and Canadian Minerals: Copper, Potash and Uranium, by D.G. Haglund and A. von Bredow; 211 pp, 1990 (\$30.00)</p> <p>M 24 Federal and Provincial Taxation of the Canadian Mining Industry: Impact and Implications for Reform, by R.W. Boadway, K.J. McKenzie, and J.M. Mintz; 207 pp, 1989 (\$35.00)</p> <p>M 23 Metals Demand and the Canadian Metal Industry: Structural Changes and Policy Implications, by C. Nappi; 145 pp, 1989 (\$25.00)</p> <p>M 22 Pricing of Metals, by M.E. Slade; 149 pp, 1988 (\$20.00)</p> <p>M 21 Mining Potential in Northern and Southern Canada: Guidelines for Regional Development Policy, by L.J. Verleun, and B.W. Mackenzie; 225 pp, 1988 (\$20.00)</p> <p>M 20 Canada and International Mineral Markets: Dependence, Instability, and Foreign Policy, by M. Webb and M. Zacher; 194 pp, 1988 (\$20.00)</p> <p>M 19 The Korean Mineral Market: Opportunities and Marketing Strategies for Canada, by O.Y. Kwon; 177 pp, 1987 (\$20.00)</p> <p>M 18 An Analysis of Japanese Coking Coal Procurement Policies: The Canadian and Australian Experience, by D.L. Anderson; 221 pp, 1987 (\$25.00)</p> <p>M 17 Canadian Mineral Policy Past and Present: The Ambiguous Legacy, by D. Yudelman; 192 pp, 1985 (\$20.00)</p> <p>M 16 National Resources and International Bargaining Power: Canada's Mineral Policy Options, by P.J. Caragata; 190 pp, 1984 (\$20.00)</p> <p>M 15 Financing Canadian Mining in the Eighties: Strategies for Action, edited by D. Yudelman, with papers by B. Bradley, A. Dorland, J. Erola, P. Gillin, S. Greenwald, B. Kalymon, P. MacCulloch, B. Mackenzie, K. Murphy, A. Powis, R. Sultan, and D. Yudelman; 240 pp, 1984 (\$20.00)</p> <p>M 14 Foreign Investment Control in the Canadian Mineral Sector: Lessons from the Australian Experience, by D.L. Anderson; 180 pp, 1983, (\$15.00)</p> <p>M 13 Profitability in the Canadian Mineral Industry, by C.H. Pye; 178 pp, 1981 (\$14.00)</p> | <p>M 12 The Role of Mineral Taxation in Industry/Government Conflict: The Case of the Saskatchewan Potash Reserve Tax, by D.L. Anderson; 135 pp, 1981 (\$9.00)</p> <p>M 11 The Impact of Policy Change on Decisions in the Mineral Industry: The Case of Exploration in Manitoba, 1969-77, by B.E. Owen and W.J. Kops; 116 pp, 1980 (\$9.00)</p> <p>M 10 Gold: The World Industry and Canadian Corporate Strategy, by E. Cousineau and P.R. Richardson; 192 pp, 1980 (\$14.00)</p> <p>M 9 Effects of Taxation on Base Metal Mining in Canada, by B.W. Mackenzie and M.L. Bilodeau; 188 pp, 1979 (\$9.00)</p> <p>M 8 Environmental Impact of Mining in Canada, by E.A. Ripley, et al; 274 pp, 1978 (\$15.00)</p> <p>M 7 Economic Impacts and Linkages of the Canadian Mining Industry, by P.E. Nickel, et al; 140 pp, 1978 (\$6.00)</p> <p>M 6 The Canadian Nonferrous Metals Industry: An Industrial Organization Study, by E. Urquhart; 158 pp, 1978 (\$9.00)</p> <p>M 5 Health and Safety in the Canadian Mining Industry, by G.W. Gibbs and P. Pintus; 248 pp, 1978 (\$12.00)</p> <p>M 4 Human Resources in Canadian Mining: A Preliminary Analysis, by J.A. MacMillan, G.S. Gislason, and S. Lyon; 174 pp, 1977 (\$12.00)</p> <p>M 3 The Transportation Impact of the Canadian Mining Industry, by A.I. Wallace; 154 pp, 1977 (\$9.00)</p> <p>M 2 The Impact of the Mining Industries on the Canadian Economy, by R.W. Boadway and J.M. Treddenick; 116 pp, 1977 (\$9.00)</p> <p>M 1 Conflict and its Resolution in the Administration of Mineral Resources in Canada, by R.M. Burns; 62 pp, 1976 (\$5.00)</p> <p>EAS 9 A Climate for Change: Alternatives for the Central and Eastern Arctic, by R.A. Graham, M.P.S. Brown, A.B. McAllister, and M.J. Wojciechowski. Final Report of the Eastern Arctic Study, 198 pp, 1984 (\$20.00)</p> |
|---|---|

- F 14E Long Distance Commuting in the Mineral Industry: Conference Summary**, edited by M. Shrimpton and K. Storey, with papers by K. Storey and M. Shrimpton, N. Lightfoot, L. Gould, J. Hopkinson, C. Loberg, C. Gitzel, J. Willson, D. Coates, T. Stevens, B. Hanson, R. Robson, K. Donnelly, P. Bray, A. Allard, R. Whiffen, C. Hinde, B. Fotherington, M. Babcock, R. Armstrong, and R. Clayton; 57 pp, 1991 (\$20.00)
- F 14F Conférence sur le transport sur de longues distances des travailleurs de l'industrie minière: Précis des exposés et des travaux d'atelier**, publié sous la direction de M. Shrimpton et K. Storey, avec présentations par K. Storey et M. Shrimpton, N. Lightfoot, L. Gould, J. Hopkinson, C. Loberg, C. Gitzel, J. Willson, D. Coates, T. Stevens, B. Hanson, R. Robson, K. Donnelly, P. Bray, A. Allard, R. Whiffen, C. Hinde, B. Fotherington, M. Babcock, R. Armstrong, et R. Clayton; 74 pp, 1991 (\$20.00)
- F 13 Human Resource Planning for the Mining Industry**, edited by L.M. Jackson, with papers by B.A. Ferguson, E. McDonnell, P.W. Parker, N. Billette, G.W. Poling, W.F. Bawden, T. Reid, S.B. Flewelling, J.A. MacDougall, T.M. Hennebury, A. Bock, J. Dixon, J.R.M. Gordon, P.R. Richardson, O. Jones, H.C. Morris, B.W. Mackenzie, D. Shannon, K.V. Konigsmann, H.P. O'Neil, and L.M. Jackson; 193 pp, 1991 (\$25.00)
- F 22 Marketing of Nonferrous Metals**, edited by L.M. Jackson and P.R. Richardson, with papers by R.J. Bauer, L. Spiess, J.E. Tilton, M.E. Slade, C. Green, R. Bhar, W.H. Drescher, W. Deeks, L.A. Morris, H. Wynne-Edwards, and L.M. Jackson; 131 pp, 1989 (\$25.00)
- F 21 Prospects for Minerals in the 90s**, edited by P.R. Richardson and R. Gesing, with papers by P.R. Richardson, N. Keovil Jr., J. Macleod, J. Cordes, S. Hunt, J. Zwartendyk, P. Perron, P. McGeer, B. Harris and A. Cecutti, and R. Gesing and M.J. Wojciechowski; 149 pp, 1988 (\$20.00)
- F 20 Long-Term Prospects for Gold Mining**, edited by B.W. Mackenzie and R. Gesing, with papers by J. Nichols, T. Green, J. Fisher, M. Murenbeid, G. Anders, R. Woodall, D. Krige, D. Cranstone, B. Mackenzie, M. Doggett, B. Kalyon, C. Margueron, M.J. Wojciechowski, and W.K. Buck; 233 pp, 1987 (\$20.00)
- F 19 Technology Policies in the Canadian Mineral Industry**, edited by M.J. Wojciechowski, with papers by R. Woodbridge, M.J. Wojciechowski, F. Pickard, D. Bevelander, J. Hood, W.G. Jeffery and J. Kurylowicz, P. Richardson, J. Schade, W. Curlook, and G. Miller, M. Sayer, G. Hatch, D. Hutchinson, and A. Molinari; 179 pp, 1986 (\$20.00)
- F 18 Structural Changes in the World Mineral Industry: Implications for Canada**, edited by M.J. Wojciechowski, with papers by P. Crowson, S. Hunt, G. Haclin, J. Davies, D. Karvonen, G. Denis, D. Daly, D. Haglund, I. Bennett, G. Mahoney, K. Buck; 213 pp, 1986 (\$20.00)
- P 17 Canadian Mining Taxation**, edited by M.J. Wojciechowski, with papers by G. Langlois, D. Williams, T. Enemark, P. Halkett, R. Albert, K. Service, K. O'Brien, R. Bowdway, J. Mintz; 144 pp, 1985 (\$20.00)
- P 16 Mining Productivity**, edited by M.J. Wojciechowski, with papers by P.R. Richardson, K. Stoßery, H. Martin, B.W. Mackenzie, C.G. Miller, W. James, P. Lepage, K. Whitham, W. Curlook, and E. Komatz; 187 pp, 1985 (\$20.00)
- P 15 Native Participation in Mineral Development Activities**, edited by M.J. Wojciechowski, with papers by A. Clark and M. Lalonde, K.A. Graham, B.W. Mackenzie, C.D. Hunt, J.-L. Blais, F.R. Joubin, E. Laliberte; 150 pp, 1984 (\$15.00)
- F 14 Mining Communities: Hard Lessons for the Future**, with papers by I. Haugh, R.P. Douglas, R. MacDonald, D. Brown, R.D. Glass and J. Lazarovich, W. Mulvihill, Denis DePape, G. Paget and B. Waliser, R. Roberts; 205 pp, 1983 (\$20.00)
- F 13 Mineral Policy Formulation: The Role of Scientific and Technical Knowledge**, with papers by B. Mackenzie, G.A. Jewett, H.D. Dreschler, P.G. Halkett, D.E. Bond, D.C. Findlay, W.G. Jeffery, L.G. Bonar, D.W. Davis, J. Zwartendyk; 135 pp, 1982 (\$12.00)
- F 12 Acid Rain Controls and the Economics of the Canadian Nonferrous Mineral Industry**, with papers by J. Gerin, W.G. Deeks, P.R. Clarke, J.B. Hyne, H.T. Fargey, B.W. Mackenzie, and E.J. Ward; 90 pp, 1982 (\$9.00)
- F 11 Skilled Manpower Shortages in the 1980s Towards a Cooperative Solution**, with papers by R.J. Gray, J.S. Reid, W.H. Digby, J.R. Hopkinson, A. Knoll, O. Tremblay, G. Beicherman, P.E. Womersley, M.J. Alton, V.C. Allman, C. Stairs, E.J. Weiss, and W.E. McBride; 116 pp, 1981 (\$9.00)
- *F 10 Northern Mining in the 80s**, with papers by G. Braden, R.J. Cathro, D. MacKinnon, J. Smith, R.W. Stephenson, B.E. Novak, E.N. Doyle, J.R. Witty, J.E. Marshall, A.G. Gordon, J. McCormack, H.B. Hicks, J. Zigartick, T. Shearcroft, W. Kupach, J. Stabler, J. Erola; 110 pp, 1980
- *P 9 The Changing Structure of the Canadian Mineral Industry**, edited by M.J. Wojciechowski, with papers by I.A. Stewart, R.F. Mikosell, R. Simeon, R. Keyes and J.M. MacLeod; 105 pp, 1980
- P 8 Mining-Linked Diversification of the Sudbury Basin Economy**, with papers by D.C. Frith, J.P. Remy, A.I. Wallace, J.H. Holtby and L.C. Kitchener; 53 pp, 1980 (\$5.00)
- P 7 The Future for Junior Mining in Canada**, with papers by Hon. J.A.C. Auld, J.L.C. Lyndon, N.B. Keovil Jr., D.G.C. Menzel, H.T. Fargey, A.J. Freyman, John. R. Hnatyshyn, J.C. Baillie, D.W. Scrim, J.P. Bunting, E.H. Neave and P.R. Richardson, L.A. English, M. St-B. Harrison, R.H. Grasley, and Hon. P. Drea; 125 pp, 1979 (\$12.00)

- *P 6** *Junior Mining in Canada: The Problem of Investment and Securing Fair Returns*, edited by M.J. Wojciechowski, with papers by A.J. Freyman, B.A. Kalymon, J.D. Mason, D.W. Scrim, E.H. Neave and P.R. Richardson, and E.G. Thompson; 101 pp, 1979
- P 5** *Employee Relations Initiatives in Canadian Mining*, with papers by W.J. Bennett, F.R. Nogas and J.P. Fulcher, W.F. Clarke, S.B. Jones, T.F. Cawsey and P.R. Richardson, and P. Warrian; 85 pp, 1979 (\$5.00)
- P 4** *Canada's Mineral Trade: Implications for the Balance of Payments and Economic Development*, with papers by B.W. Wilkinson, D.J. McCulla, J.G. MacKinnon, A.G. Balogh, W.G. Chambers and J.S. Reid; 113 pp, 1978 (\$9.00)
- P 3** *Current Concerns in Mineral Policy*, with papers by C.R. Archibald, W.J. Barbour, D.B. Brooks, J.S. Dowsett, J.M. Fleming, and G.A. Jewett; 75 pp, 1978 (\$5.00)
- P 2** *International Competition and the Canadian Mineral Industries*, with papers by H.C. Armstrong, H.T. Fargay, C.G. Miller, N.D. Olewiler and P.R. Richardson, D. Perlstein, and K.C. Hendrick; 109 pp, 1978 (\$9.00)
- *P 1** *Rate-of-Return Taxation of Minerals*, edited by P.R. Richardson and N.D. Olewiler, with papers by B.W. Mackenzie and M.L. Bilodeau, P.M.T. White, N.D. Olewiler, J.T. Cawley, and E.P. Guah; 109 pp, 1978

Working Papers

- WF 48** *The Development and Restructuring of China's Metal Mining Industry*, by Xu Tao; 51 pp, 1991 (\$15.00)
- WF 47** *Sulphur Mining in Poland*, by L. Preisner; 26 pp, 1991 (\$20.00)
- WF 46** *The Evolution of the Manufacturing Component in the Ontario Metal Mining Industry*, by A.G. Green and M.A. Green; 60 pp, 1991 (\$15.00)
- WF 45** *Response to Crisis: The Ontario Metal Mining Industry, 1975-1985*, by A.G. Green and M.A. Green; 35 pp, 1991 (\$15.00)
- WF 44** *Economic Aspects of Gold Exploration: How Much Is Too Much*, B.W. Mackenzie and M. Doggett; 30 pp, 1989 (\$10.00)
- WF 43** *Long Distance Labour Commuting in the Canadian Mining Industry*, by K. Storey and M. Shrimpton; 45 pp, 1989 (\$10.00)
- WF 42** *The Changing Transportation Environment of the Canadian Mineral Industry*, by I. Wallace; 37 pp, 1987 (\$10.00)
- WF 41** *Economic Trends in Canadian Gold Supply*, by B.W. Mackenzie and M. Doggett; 80 pp, 1987 (\$10.00)
- WF 40** *Mineral Exploration Economics: The Search for Base Metals in Australia and Canada*, by B.W. Mackenzie and R. Woodall; 112 pp, 1987 (\$15.00)
- WF 39** *Flow-Through Share Financing*, by B. Kalymon; 63 pp, 1987 (\$10.00)
- WF 38** *Value-Added Taxation: Issues and Impact for Canadian Mines*, by B.J. Dyack; 62 pp, 1986 (\$10.00)
- WF 37** *Intergovernmental Mineral Commodity Arrangements*, by W.K. Buck; 70 pp, 1986 (\$10.00)
- WF 36** *Mine Infrastructure and Economic Development in North Australia*, by C. O'Faircheallaigh; 104 pp, 1986 (\$15.00)
- WF 35** *Effects of Location on the Competitive Position of Mineral Exploration and Development Opportunities in Canada*, by B.W. Mackenzie, D.W. Davis and M.L. Bilodeau; 72 pp, 1986 (\$10.00)
- WF 34** *Mining and the Macdonald Commission: The State of the Industry in the Mid-1980s*, by D. Yudelman; 116 pp, 1985 (\$15.00)
- WF 33** *The Origin of Public Enterprise in the Mineral Sector: Three Provincial Case Studies*, by M.J. Prince and G.B. Doern; 143 pp, 1985 (\$15.00)
- WF 32** *Productivity and Price: The Case of Gold in Ontario*, by A.G. Green; 54 pp, 1984 (\$10.00)
- WF 31** *Federal Policy and the Role of the Public Enterprise in the Mining Sector*, by M.J. Prince and G.B. Doern; 52 pp, 1984 (\$10.00)
- WF 30** *Canadian Mineral Policy Formulation: A Case Study of the Adversarial Process*, by D. Yudelman; 83 pp, 1984 (\$10.00)
- *WF 29** *Dominant Government Firms in an Oligopolistic Industry: The Case of Saskatchewan Potash*, by F. Flatters and N. Olewiler; 42 pp, 1984
- WF 28** *Economic Mineral Exploration Targets*, by B.W. Mackenzie; 72 pp, 1984 (\$10.00)
- *WF 27** *The Prospects for Canadian Uranium*, by S. Salaff; 50 pp, 1983
- *WF 26** *Effects of Public Policy on Investment Demand: The Case of Taxation in Canadian Base Metal Mining*, by B.W. Mackenzie and C.H. Pye; 58 pp, 1982
- WF 25** *Economic Guidelines for Small Mineral Deposit/Directives économiques relatives aux petits gisements*, by B.W. Mackenzie and M.L. Bilodeau; 66 pp, 1982 (\$7.00)
- WF 24** *The Costs of Uncertainty: Regulating Health and Safety in the Canadian Uranium Industry*, by I. Robinson; 74 pp, 1982 (\$9.00)
- WF 23** *Effects of Water Pollution Control Costs on Base Metal Mining in Canada*, by N.A. Papanicolaou and B.W. Mackenzie; 74 pp, 1981 (\$6.00)
- WF 22** *Newfoundland Mining Industry: Present Status and Potential for Expansion*, by N.D. Olewiler and C.H. Pye; 206 pp, 1980 (\$14.00)
- WF 21** *Public Affairs and the Minerals Industry: Junior Mining: Northern Development Loans for Foreign Mines: A Public Relations Strategy*, by C.G. Miller; 42 pp, 1980 (\$5.00)
- WF 20** *The Market Price of Risk in the Canadian Mining Industry*, by H.F. Campbell; 29 pp, 1980 (\$5.00)

- *WP 15 *Looking for the Improbable Nod in a Haystack: The Economics of Base Metal Exploration in Canada*, by B.W. Mackenzie, 48 pp, 1980
- WP 18 *An Economic Analysis of the Canadian Taxation of an Integrated Mining Company*, by J.-T. Bernard; 112 pp, 1980 (\$9.00)
- WP 17 *Constitutional Change and the Mineral Industry in Canada*, by W. MacDonald; 66 pp, 1979 (\$5.00)
- WP 16 *Canada's Competitive Position in Copper and Zinc Markets*, by B.W. Mackenzie; 41 pp, 1979 (\$5.00)
- *WP 15 *Public Policy Aspects of Information Exchange in Canadian Mineral Exploration*, by D.O. Downing and B.W. Mackenzie; 52 pp, 1979
- *WP 14 *The Administration of Mineral Exploration in the Yukon and Northwest Territories*, by K.A. Graham, R.G. McEachern and C.G. Miller; 42 pp, 1979
- WP 13 *Corro Cokerado: A Case Study of the Role of Canadian Crown Corporations in Foreign Mineral Development*, by C.G. Miller, N.D. Otewiler, and P.R. Richardson; 44 pp, 1979 (\$5.00)
- *WP 12 *Solar Energy and the Canadian Mining Sector: A Demand Forecast*, by J.S. Shewchuk and D.B. Curtis; 45 pp, 1978
- *WP 11 *A Survey of Resources and a Production Cycle for the Nonferrous Metals*, by C. Lafkas and J.G. Paterson; 44 pp, 1978
- WP 10 *Canada as a World Zinc Producer: Prospects to 1980*, by N.D. Otewiler, P.R. Richardson, and L. Rumble; 22 pp, 1978 (\$5.00)
- WP 9 *Trends in Canada's Mineral Trade*, by B.W. Wilkinson; 63 pp, 1978 (\$5.00)
- WP 8 *Federal Mineral Policies: 1945-73*, by M.J. Wojciechowski; 85 pp, 1979 (\$5.00)
- *WP 7 *Provincial Mineral Policies: New Brunswick, Nova Scotia, 1945-77*, by A. Koven; 37 pp, 1978
- *WP 6 *Provincial Mineral Policies: Saskatchewan, 1945-77*, by R.C. Murray; 64 pp, 1978
- *WP 5 *Provincial Mineral Policies: Ontario, 1945-77*, by R. Hynes; 48 pp, 1978
- *WP 4 *Provincial Mineral Policies: Quebec, 1945-77*, by S. Guindon; 49 pp, 1977
- *WP 3 *Provincial Mineral Policies: Newfoundland, 1945-77*, by M.J. Prince; 67 pp, 1977
- *WP 2 *Risk and Return in the Canadian Mining Industry*, by A.M. Rugman; 64 pp, 1977
- *WP 1 *An Analysis of the Recent Federal Tax Changes Affecting the Canadian Mining Industry*, by J.-T. Bernard; 27 pp, 1977

Technical Papers

- T 11 *Canadian University Research and Teaching Resources in Advanced Industrial Materials*, J.M. McIntosh; 71 pp, 1991 (\$20.00)

- T 10 *Economic Potential of Base Metal and Gold Mining in Newfoundland: Assessing the Impact of Regional Development Policy Options*, by B.W. Mackenzie, M.L. Bilodeau, and M. Doggett; 201 pp, 1989 (\$25.00)
- T 9 *Mineral Exploration and Mine Development Potential in Ontario: Economic Guidelines for Government Policy*, by B.W. Mackenzie, M.L. Bilodeau, M. Doggett; 209 pp, 1989 (\$25.00)
- T 8 *An Inter-Sectoral Study of Canada's Resource Industries*, by T. Bennett and D.L. Anderson; 197 pp, 1988 (\$25.00)
- T 7 *Innovation in the Mineral Industry: Opportunities and Strategies for Canada*, by M.J. Wojciechowski and P.R. Richardson; 278 pp, 1987 (\$27.00)
- T 6 *Geological Aspects of Mining Productivity*, by B.W. Mackenzie; 115 pp, 1985 (\$15.00)
- *T 5 *Sourcebook for Native Participation in Canadian Mineral Activities*, by M.J. Wojciechowski and K.A. Graham; 165 pp, 1985
- T 4 *Mineral Technology Transfer: Evaluation of the CANMET Pit Slope Project*, by B.W. Mackenzie and R. Pakalnis; 200 pp, 1985 (\$20.00)
- T 3 *Secondary Supply of Copper and Ferrous Metals and Canadian Metal Markets*, by K.R. Stollery; 118 pp, 1983 (\$15.00)
- T 2 *Economic Effects of Smelter Controls on the Canadian Nonferrous Mining Industry*, by B.W. Mackenzie and M. Bilodeau; 162 pp, 1982 (\$15.00)
- *T 1 *Financing and Stabilization Policies in a Cyclical Industry: The Case of Inco in the Seventies*, by W.T. Cannon; 200 pp, 1981

Mineral Policy Updates

- *MP 84 *Mineral Policy Update: 1984*, by M.J. Wojciechowski; 118 pp, 1985
- MP 83 *Mineral Policy Update: 1983*, by M.J. Wojciechowski; 88 pp, 1984 (\$8.00)
- MP 82 *Mineral Policy Update: 1982*, by M.J. Wojciechowski and C.E. McMurray; 88 pp, 1983 (\$7.00)
- MP 81 *Mineral Policy Update: 1981*, by M.J. Wojciechowski and C.E. McMurray; 85 pp, 1983 (\$7.00)

Eastern Arctic Study

- *EAS 10 *Eastern Arctic Study Case Study Series: Beaufort Sea Oil and Gas Development*, by M.P.S. Brown, K.A. Graham, and M.J. Wojciechowski; 85 pp, 1985
- EAS 9 *A Climate for Change: Alternatives for the Central and Eastern Arctic*, by K.A. Graham, M.P.S. Brown, A.B. McAllister, and M.J. Wojciechowski; 184 pp, 1984 (\$15.00)
- *EAS 8 *Eastern Arctic Study Case Study Series: James Bay Settlement*, by A.B. McAllister; 61 pp, 1985

- EAS 7 **Eastern Arctic Study Annotated Bibliography**, by M.P.S. Brown; 68 pp, 1984 (\$5.00)
- EAS 6 **Eastern Arctic Study Case Study Series: The Nanisivik Mine**, by M.J. Wojciechowski; 62 pp, 1982 (\$5.00)
- *EAS 5 **Eastern Arctic Study Case Study Series: The Development of the Polaris Mine**, by K.A. Graham; 61 pp, 1982
- EAS 4 **Eastern Arctic Study Case Study Series: Mineral Exploration Baker Lake Area**, by A.B. McAllister; 58 pp, 1982 (\$5.00)

- *EAS 3 **Eastern Arctic Study Case Study Series: The Alaska Native Claims Settlement**, by D. Baker; 100 pp, 1982
- *EAS 2 **Industrial Development in the Eastern Arctic Study Areas: A Preliminary Overview**, by C.G. Miller; 31 pp, 1981
- EAS 1 **The Inuit Land Claim, Constitutional Development, and Local Government Reform in the Northwest Territories: An Overview**, by K.A. Graham and A.B. McAllister; 50 pp, 1981 (\$5.00)

CRS Internal Reports

Research and Development in the Earth Sciences, Canadian Geoscience Council Final Report, by M.J. Wojciechowski; 97 pp, 1989 (\$15.00)

R&D Funding Trends in Earth Sciences in Canada, Background Study for International Comparison of Earth Science R&D Expenditures, by M.J. Wojciechowski; 209 pp, 1989 (\$25.00)

R&D Funding Trends in Earth Sciences in Australia, Background Study for International Comparison of Earth Science R&D Expenditures, by M.J. Wojciechowski; 49 pp, 1989 (\$10.00)

R&D Funding Trends in Earth Sciences in Finland, Background Study for International Comparison of Earth Science R&D Expenditures, by M.J. Wojciechowski; 47 pp, 1989 (\$10.00)

R&D Funding Trends in Earth Sciences in Sweden, Background Study for International Comparison of Earth Science R&D Expenditures, by M.J. Wojciechowski; 51 pp, 1989 (\$10.00)

R&D Funding Trends in Earth Sciences in the United Kingdom, Background Study for International Comparison of Earth Science R&D Expenditures, by M.J. Wojciechowski; 41 pp, 1989 (\$10.00)

R&D Funding Trends in Earth Sciences in the United States, Background Study for International Comparison of Earth Science R&D Expenditures, by M.J. Wojciechowski; 43 pp, 1989 (\$10.00)

Research and Development in the Mineral Sector, CANMET Final Report, by M.J. Wojciechowski; 87 pp, 1989 (Available from CANMET)

Research and Development Trends in the Mineral Sector in Canada, Background Study for CANMET Final Report, by M.J. Wojciechowski; 175 pp, 1989 (\$25.00)

Research and Development Trends in the Mineral Sector in Australia, Background Study for CANMET Final Report, by M.J. Wojciechowski; 47 pp, 1989 (\$10.00)

Research and Development Trends in the Mineral Sector in Finland, Background Study for CANMET Final Report, by M.J. Wojciechowski; 43 pp, 1989 (\$10.00)

Research and Development Trends in the Mineral Sector in France, Background Study for CANMET Final Report, by Natalie Proulx and M.J. Wojciechowski; 23 pp, 1989 (\$10.00)

Research and Development Trends in the Mineral Sector in Germany, Background Study for CANMET Final Report, by M.J. Wojciechowski; 37 pp, 1989 (\$10.00)

Research and Development Trends in the Mineral Sector in Sweden, Background Study for CANMET Final Report, by M.J. Wojciechowski; 47 pp, 1989 (\$10.00)

Research and Development Trends in the Mineral Sector in the United Kingdom, Background Study for CANMET Final Report, by Kevin O'Grady and M.J. Wojciechowski; 33 pp, 1989 (\$10.00)

Research and Development Trends in the Mineral Sector in the United States, Background Study for CANMET Final Report, by Kevin O'Grady and M.J. Wojciechowski; 39 pp, 1989 (\$10.00)